

CO₂ Capture & Storage from Coal Power



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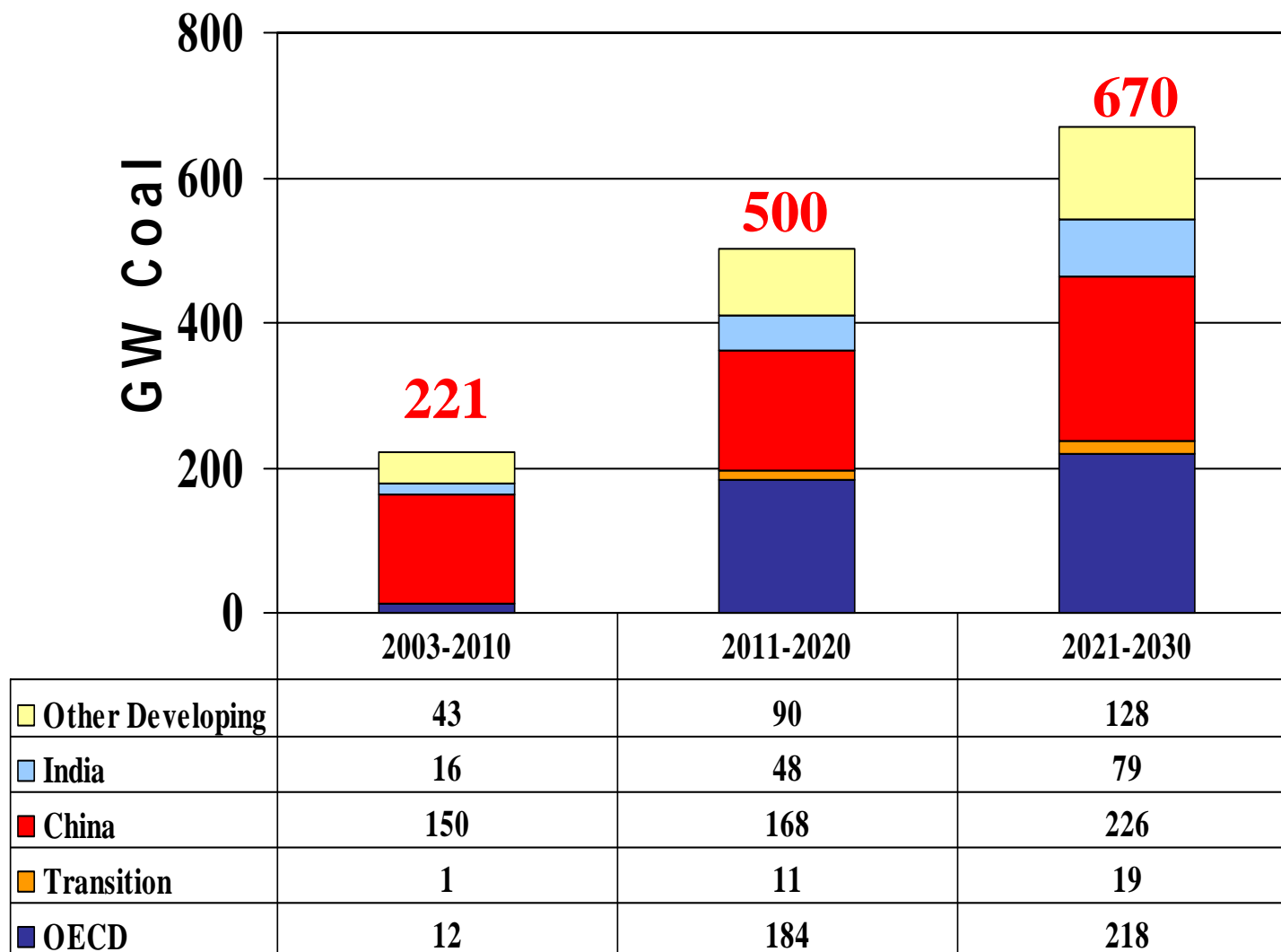
Key Points

- What CA buys determines what gets built.
- Buying new coal that cannot affordably capture CO₂ would be a colossal mistake.
- IF new coal is bought by CA, the costs and risks of requiring CO₂ capture are modest.

Investments Today Drive Climate Impacts Tomorrow

- Investments drive emissions
- Emissions drive concentrations
- Concentrations drive temperature forcing
- Forcing drives climate impacts

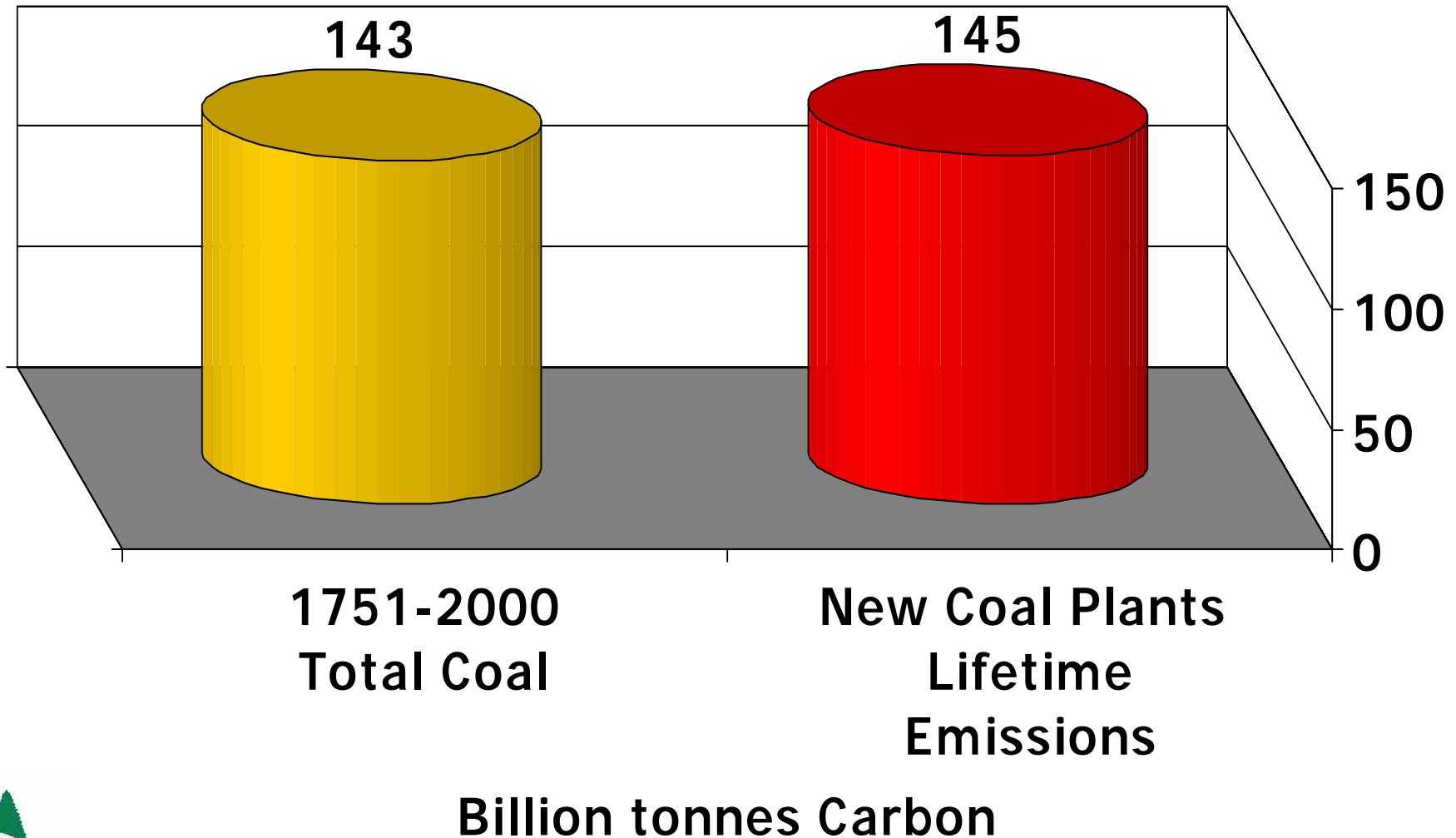
Global New Coal Build by Decade



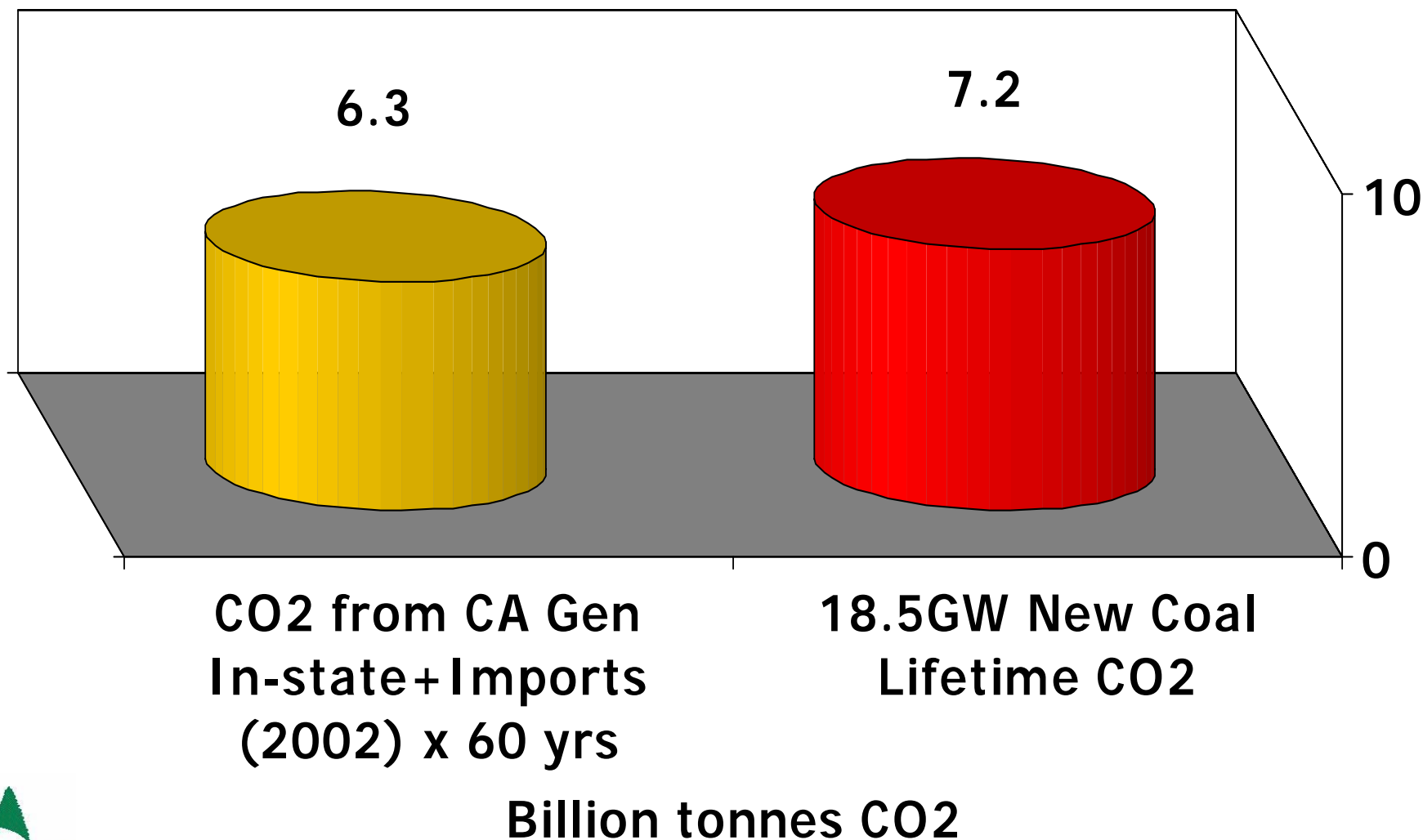
Incremental new coal capacity by decade

Source: IEA, WEO 2004

New Coal Plant Emissions Equal All Historic Coal CO₂



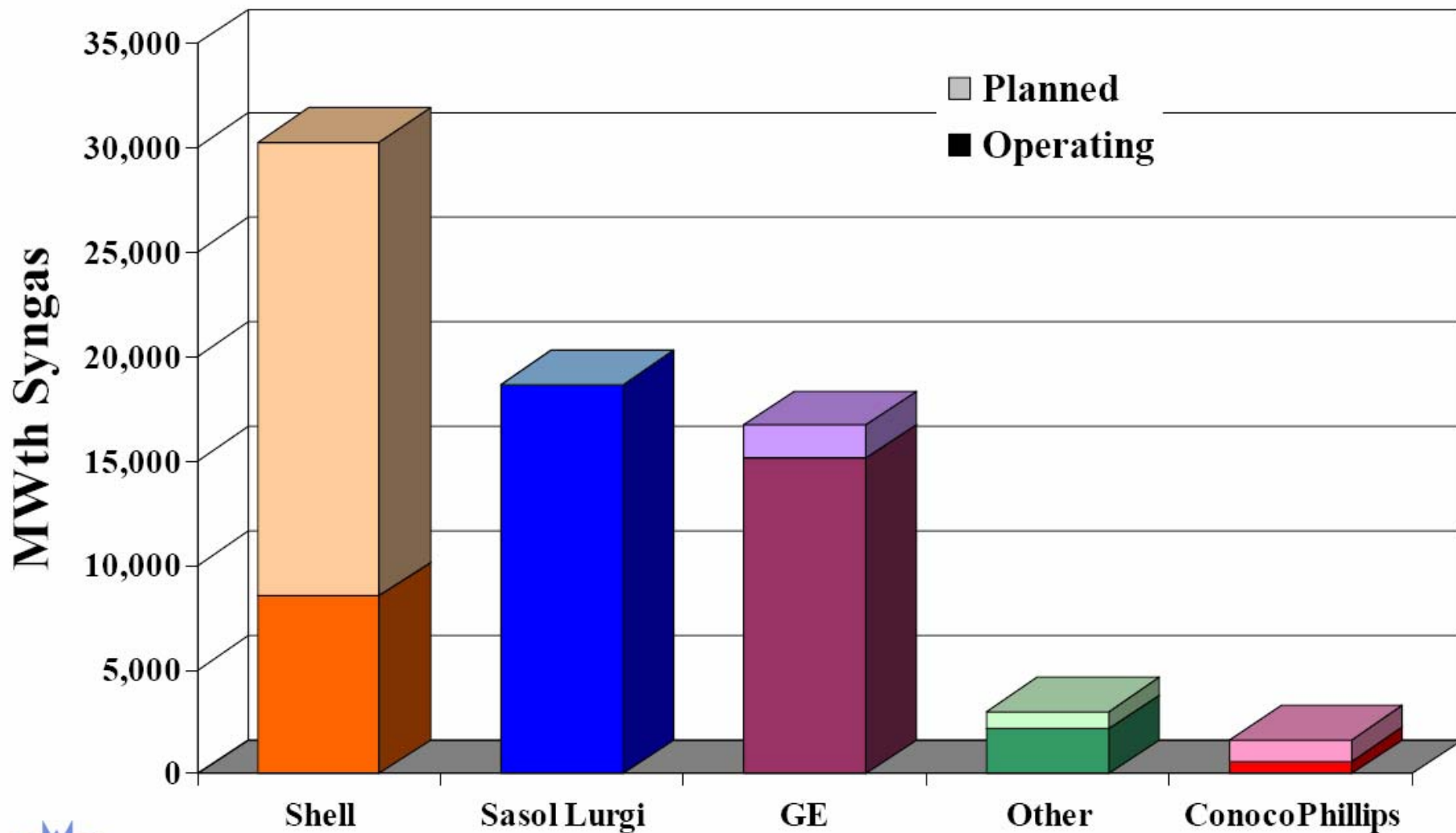
Near-term CO2 Lock-In, Proposed Western Coal Plants



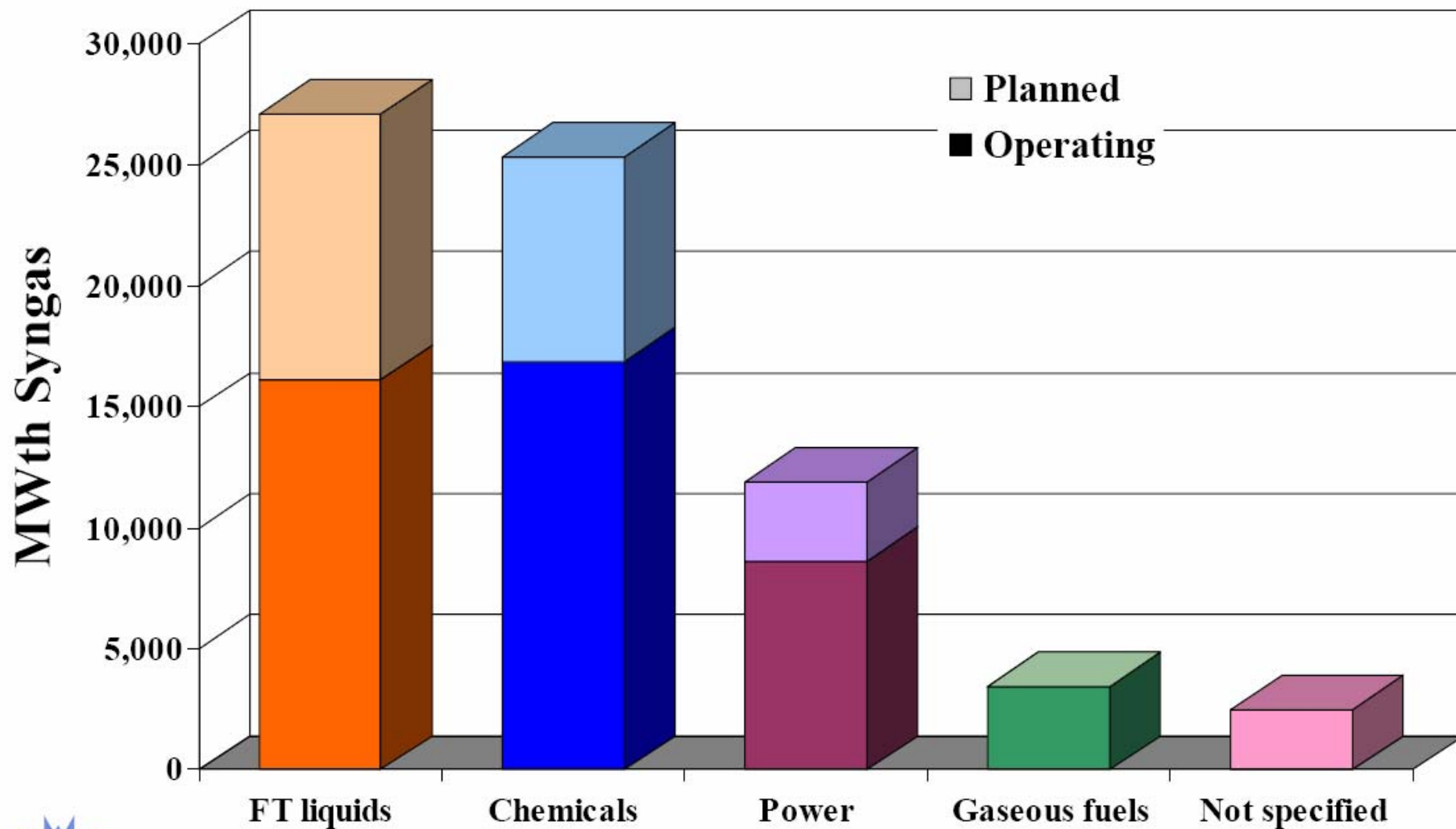
Can Coal & Climate Protection Co-exist?

- Only if CO₂ from coal is captured and permanently stored.
- Current pulverized coal designs cannot affordably capture CO₂.
- Gasification and CO₂ capture are commercially demonstrated.
- Other systems may emerge with adequate policy framework.

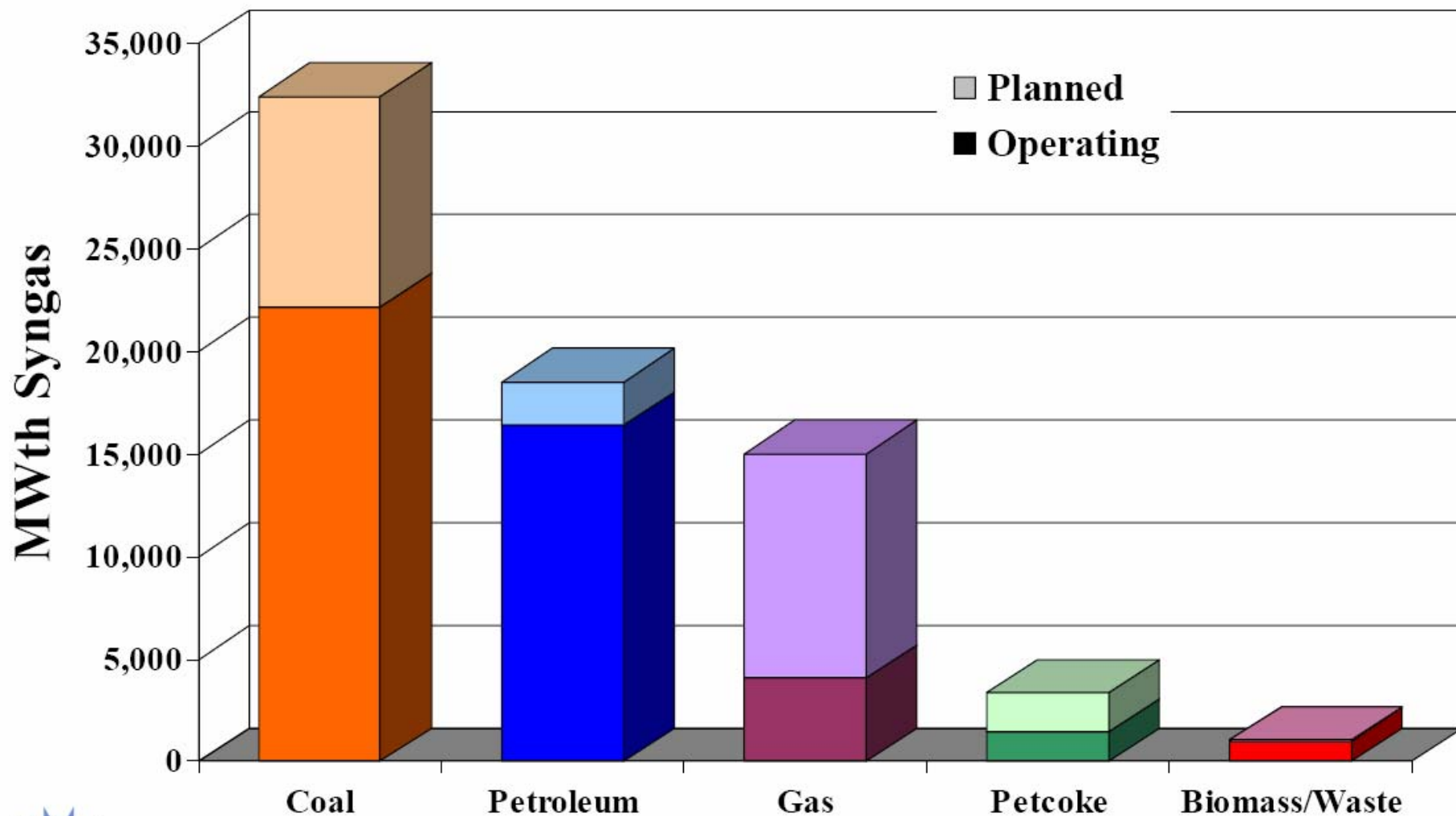
Gasification by Technology



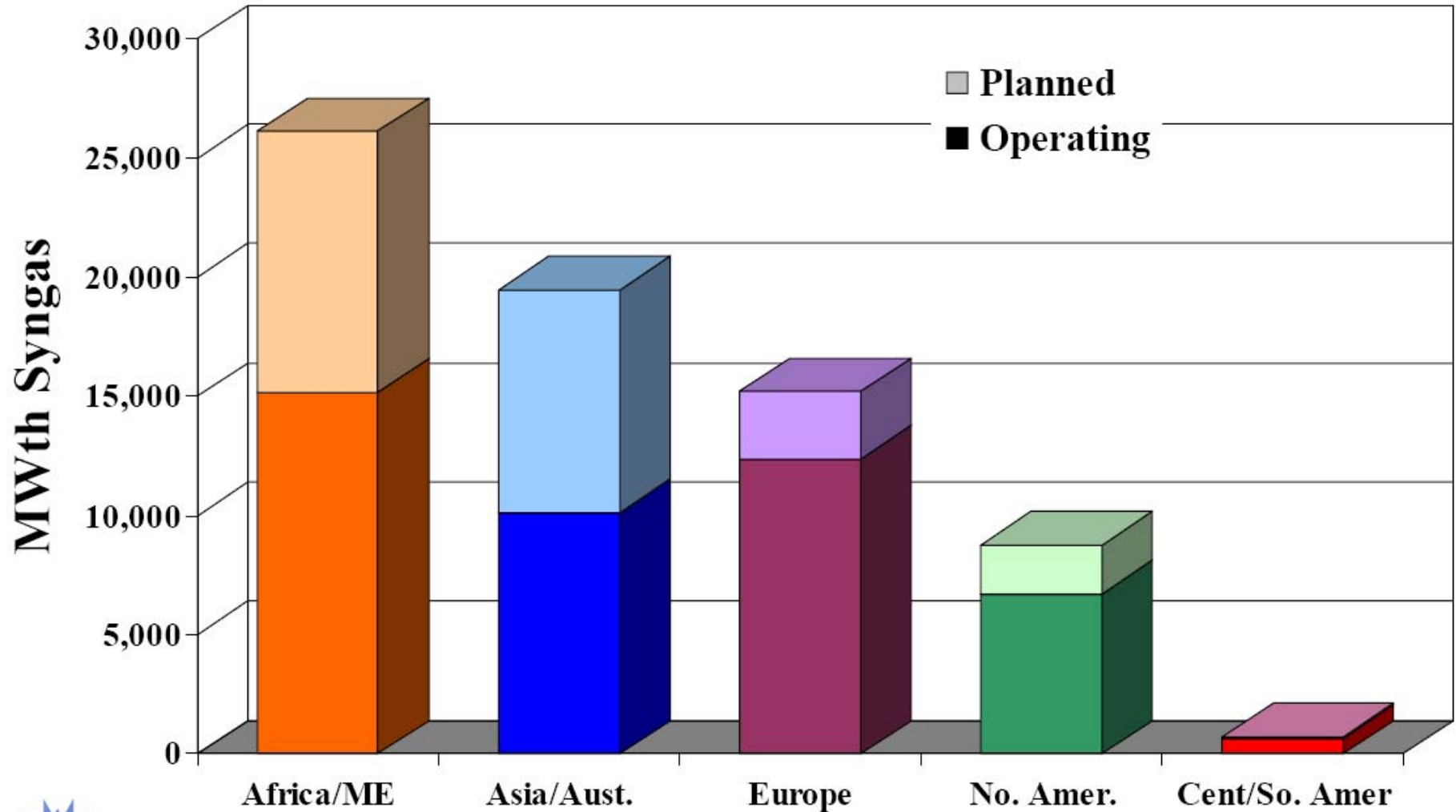
Gasification by Product



Gasification by Primary Feedstock



Gasification by Region



NETL 2004 Database

Total gasification operating: 117 plants
385 gasifiers
45,925 MWth syngas capacity
49% based on coal
19% for electric power

Total coal gasification: 22 plants
4 operational IGGC plants
180 gasifiers
22,143 MWth syngas capacity

Total specified low-rank coal:* 5 plants op. & 2 planned
1 IGCC op. & 1 planned
121 gasifiers op.
16,649 MWth syngas cap op.

CO₂ Separation/Capture

- Mature commercial practice in many natural gas processing and H₂ production plants.
- Slipstream operation at several conventional coal units.
- Dakota Gasification Plant (lignite) captures 1 million tpy CO₂

CO2 Geologic Injection

- Near 30 yrs experience in U.S. with EOR. 30 million tpy CO2 (60 million including recycle)
- Labarge gas plant (WY): several million tpy CO2 to EOR in WY and CO
- Weyburn: 1 million tpy CO2 from Dakota Gasification plant.
- Sleipner: 1996 start; 1 million tpy
- In Salah: 2005 start; 1 million tpy

Gasification Experience: Power

- Dow/Destec 1987-1993

subbituminous coal;

operated 160MW CC power block.

Single gasifier availability of 65-75% for periods of several months. Record month=88% availability.

- Polk—Tampa FL

55/45 pet coke/coal blend

lowest dispatch cost in TECO fleet

2004 stats:

96% generation availability with gas backup

82% gasifier availability

Gasification Experience: Power--2

- Wabash River—IN
 - 2004—not operating; business dispute
 - All petcoke in 2003
 - 74% gasifier availability 2003
 - Avg. gasifier availability of 74.6% 2001-2003
- NUON- Buggenum, NL
 - 64.6% IGCC availability 2003
 - 94.8% generation availability with gas backup
- Elcogas, Spain
 - 63.7% IGCC availability 2002
 - 74.9% gasifier availability 2002

Gasification Vendor Trends

- Business model changing from licensing to full plant turnkey packages
 - GE/Bechtel
 - ConocoPhillips/Fluor/Siemens
 - Shell/Uhde/Black & Veatch

CO2 Capture & Storage is Affordable

	Percent increase in forecast average CA retail rates— 2013	
GW coal with CCS	BIT	SUB
1	0.53%	0.62%
5	2.66%	3.11%

Assumptions: incremental COE (c/kwh)=2.4/2.8 (BIT/SUB),
compared to pulverized coal w/o CCS.

Includes \$7/ton CO2 storage costs.

Forecast 2013 average retail rate = 12.2 c/kwh

Warming Won't Wait. Will We?

